REMARKS

The Office Action dated December 6, 2005 has been received and carefully noted. The following remarks are submitted as a full and complete response thereto.

The Applicants wish to thank the Examiner for indicating allowable subject matter in claims 18, 21, 23, 24, and 28-31.

As will be discussed below, it is also requested that all of claims 17, 19, 20, 22, 25-27, and 32 be found allowable as reciting patentable subject matter.

Claims 17-32 stand rejected and pending and under consideration.

REJECTION UNDER 35 U.S.C. § 102:

In the office action, at page 2, claims 17, 19, 20, 22, 25-27, and 32 were rejected as being anticipated by U.S. Patent No. 5,404,086 to Takenaka et al. ("Takenaka"). According to the office action, Takenaka discloses a legged mobile robot having a body and a plurality of legs connected to the body through joints and having a foot connected to a distal end of the leg through a second joint. Also, according to the office action, Takenaka describes element 100 as an elastic member that contracts in response to a load and is installed at a position between the second joint and a floor contact end of the foot. According to the office action, claim 10 of Takenaka describes a displacement sensor and column 4, line 4, of Takenaka describes means to measure the floor reaction force. This rejection is traversed and reconsideration is requested.

Independent claim 17, upon which claims 18-24 are dependent, recites a legged mobile robot having at least a body and a plurality of legs each connected to the body through a first joint and each having a foot connected to a distal end of the leg through a second joint. An elastic member is provided that contracts in response to a load and is installed at a position between the second joint and a floor contact end of the foot. A displacement sensor is installed in a space defined by a top-to-bottom height of the elastic member such that a displacement of the floor contact end of the foot relative to the second joint can be detected.

Independent claim 25, upon which claims 26-31 are dependent, recites a legged mobile robot having at least a body and a plurality of legs each connected to the body through a first joint and each having a foot connected to a distal end of the leg through a second joint. A plurality of displacement sensors are installed in a space defined by a first rigid member connected to the second joint and a second rigid member connected to a floor contact end of the foot at locations spaced apart with each other when viewed from top, and producing outputs indicative of a displacement of the floor contact end of the foot relative to the second joint. A discriminator discriminates whether the outputs of the displacement sensors satisfy a predetermined geometric relationship. A self-diagnoser self-diagnoses whether at least one of the displacement sensors is abnormal based on a discrimination result of the discriminator.

Independent claim 32 recites a floor reaction force detection system of a legged mobile robot having at least a body and a plurality of legs each connected to the body

through a first joint and each having a foot connected to a distal end of the leg through a second joint. A displacement sensor is installed at a position in or adjacent to an elastic member that contracts in response to a load and is positioned between the second joint and the foot and producing an output indicative of a displacement of the floor contact end of the foot relative to the second joint. A floor reaction force calculator calculates the floor reaction forces acting on the foot based on the output of the displacement sensor.

As will be discussed below, Takenaka fails to disclose or suggest the elements of any of the presently pending claims.

Takenaka generally describes a system for controlling a legged mobile robot including a mechanical compliance mechanism 100 operating to bend (deform) by an amount corresponding to the angle (the interference angle) as illustrated in FIG. 7. See column 8, lines 19-24. Column 7, lines 53-65, of Takenaka describes that a robot's posture inclination DPI and joint displacements DJD are detected through the outputs of the inclinometer and encoders. The robot's possible floor contact portion's position (foot's position) in the absolute coordinate system, whose one axis corresponds to the gravitational direction, is calculated through kinematic calculation to determine the virtual plane including wholly or partly the possible floor contact portion.

According to Takenaka, the virtual plane's inclination is estimated using the detected joint displacements. An inclinatory error between supposed and actual floors is estimated and the desired walking pattern is corrected in response to the inclinatory error. See column 10, lines 15-20. Specifically, as illustrated in the lower left of FIG. 3 of

Takenaka, by virtually rotating the possible contact portion in the desired walking pattern DWP by the interference angle, a corrected posture is calculated through the inverse-kinematic calculation and joint displacements of the posture thus corrected are then calculated.

However, contrary to the contentions made in the office action, the combination of the inclinometer and encoders of the mechanical compliance mechanism 100 of Takenaka do not provide for an elastic member that would **contract** in response to a load and a displacement sensor that is installed in a space defined by a **top-to-bottom height** of the elastic member. Emphasis added. Takenaka does not teach or suggest, at least, "a displacement sensor installed in a space defined by a top-to-bottom height of the elastic member such that a displacement of the floor contact end of the foot relative to the second joint can be detected," as recited in independent claim 17. Takenaka is concerned with detecting an inclinatory error rather than detecting a displacement of the floor contact end of the foot relative to the second joint as in the present invention.

The methods described in the embodiments of Takenaka are directed to the posture of the robot at an inclination and determining and correcting an inclinatory error. The office action refers to claim 10 of Takenaka as providing the recitations of the displacement sensor recited in independent claim 17. However, claim 10 of Takenaka only provides "means for calculating averages of the detected joint displacement and joint displacement commands." Although the term "displacement" is recited in claim 10 of Takenaka, that alone does not provide the recitations of the displacement sensor of

independent claim 17. Specifically, claim 10 of Takenaka does not provide that the means for calculating averages of the detected joint displacement and joint displacement commands is installed in a space defined by a top-to-bottom height of the elastic member. Also, claim 10 of Takenaka does not provide that the means for calculating averages of the detected joint displacement and joint displacement commands is installed such that a displacement of the floor contact end of the foot relative to the second joint can be detected. Rather, in view of the description provided in the specification of Takenaka and claim 10 of Takenaka, the means for calculating averages of the detected joint displacement and joint displacement commands to determine the posture of the robot from the detected actual **inclination** of the robot posture and the averages of the detected joint displacements and joint displacements commands. Emphasis added. Accordingly, the recitations of independent claim 17 are not anticipated by Takenaka.

Referring to independent claim 25 of the present invention, this claim recites, "a plurality of displacement sensors installed in a space defined by a first rigid member connected to the second joint and a second rigid member connected to a floor contact end of the foot at locations spaced apart with each other when viewed from top, and producing outputs indicative of a displacement of the floor contact end of the foot relative to the second joint; a discriminator discriminating whether the outputs of the displacement sensors satisfy a predetermined geometric relationship; and a self-diagnoser self-diagnosing whether at least one of the displacement sensors is abnormal based on a discrimination result of the discriminator." As previously indicted, Takenaka fails to

teach or suggest producing outputs indicative of a displacement of the floor contact end of the foot relative to the second joint. Instead, Takenaka provides generating an inclination error and correcting for such error.

Further, the office action refers to claim 21 of Takenaka as describing the recitations of independent claim 25. Claim 21 of Takenaka provides first means for modeling the robot as a rigid linkage mechanism, second means for detecting actual inclination, third means for determining the posture of the robot, fourth means for determining a relative relationship between the determined robot posture and the supposed floor, fifth means for estimating floor reaction force, sixth means for detecting floor reaction force that actually acts to the robot, and seventh means for determining an error to correct an output of an inclinometer. However, Takenaka is devoid of any teaching or suggestion providing the recitations of the discriminator of independent claim 25. Claim 21 of Takenaka does not provide means for discriminating whether the outputs of the displacement sensors satisfy a predetermined geometric relationship as recited in independent claim 25 of the present invention. Rather, Takenaka provides in claim 21 a combination of a system to correct an output of an inclinometer. Furthermore, contrary to the contentions made in the office action, none of the seven means recited in claim 21 of Takenaka provides self-diagnosing whether at least one of the displacement sensors is abnormal based on a discrimination result of the discriminator. Accordingly, Takenaka does not anticipate independent claim 25 and related dependent claims.

In addition, independent claim 32 of the present invention recites, "a displacement sensor installed at a position in or adjacent to an elastic member that contracts in response to a load and is positioned between the second joint and the foot and producing an output indicative of a displacement of the floor contact end of the foot relative to the second joint." Because independent claim 32 include similar claim features as those recited in independent claim 17, although of different scope, and because the office action refers to similar portions of Takenaka to reject independent claim 32, the arguments presented above supporting the patentability of independent claim 17 are incorporated herein to support the patentability of independent claim 32.

CONCLUSION:

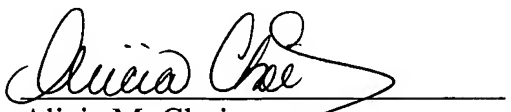
In view of the above, Applicant respectfully submits that the claimed invention recites subject matter which is neither disclosed nor suggested in the cited prior art. Applicant further submits that the subject matter is more than sufficient to render the claimed invention unobvious to a person of skill in the art. Applicant therefore respectfully requests that each of claims 17, 19, 20, 22, 25-27, and 32 be found allowable and, along with allowed claims 18, 21, 23, 24, and 28-31, this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time.

Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



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